

PROJECT 325A
SUMMARY REPORT

PERIOD: OCTOBER 1, 1971 to OCTOBER 31, 1971

Submitted By:
Project Manager

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TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
1.0 CHEMICAL R AND D	
<u>Materials' Purification and Synthesis</u>	1
D260:	1
Carbon Tetrabromide:	1
Polystyrene Binder:	2
New Materials:	2
<u>Film Studies</u>	3
D7 and 4PO:	3
CBr ₄ :	3
Silicone Oil:	4
Coating Thickness Variation:	4
Chemical-Binder Ratio:	4
<u>Pilot Coating</u>	5
2.0 PHYSICAL AND OUTGASSING TESTS	9
<u>Modulus of Elasticity</u>	9
<u>Film Resistivity</u>	9
<u>Creep Test</u>	9
<u>Film Friction + Sticking Test</u>	10
<u>Film Outgassing</u>	10
<u>Compatibility Testing</u>	10
<u>Scuffing Resistance</u>	10
3.0 ENGINEERING	
<u>Granularity Measurements</u>	11
<u>Optical Probe</u>	11
<u>Pilot Coating - Process Air and Ventilation</u>	11
Scope of Project:	11
Specifications:	12

SECTIONPAGEPilot Coating - Temp. Control for Process Dryers

Scope: 18
Specifications: 18

Microdensitometer 18

Red Light Developments 19

Silicone Additive: 19

Use of Environmental Cover: 19

Effect of Time Delay Between Optical

Development and Solvent Fix: 20

Electroluminescent Panels: 20

4.0 SHELF-LIFE/SPEED DECAY 30

PROBLEMS 30

FINANCIAL 30

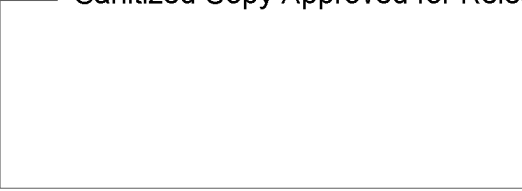
PLANS FOR NEXT REPORTING PERIOD 30


ABSTRACT

The main project thrust, during this reporting period, has been chemical preparation and scale-up for trial coatings of 325A materials. Intensive work was carried out in looking for a proper binder and solvents for the base subbing and photosensitive layer pilot coating. Dummy runs were made without 325A light active ingredients to determine physical uniformity, viscosities, thickness and machine running parameters. Make-dark provisions were incorporated in the coating clean room. Personnel have been trained with blind-fold and under dark conditions on pilot coating procedures for 325A. Safety lights and equipment have been installed. Engineering documentation was completed for placing purchase orders for the improvements in air handling, air conditioning and heater controls on the pilot coater.

Preliminary data on outgassing and physical properties of the laboratory hand coated samples has been reported by Perkin Elmer.

Three additional HID-1 red-lite developer laboratory units will be completed by November 7th. Work has started on partial atmosphere effects on hand coated sample sensitivity and red-lite processing.



1.0 CHEMICAL R and D

Materials' Purification and Synthesis

D260:

Additional batches of photograde D260 have been purified without difficulty and supplies are available to meet the demand of at least several months' research. In addition, about 1/3 of the estimated requirement of D260 for pilot coating for the remainder of 1971 is already stocked piled.

Delivery of the first 0.5 kg of D260 from ChemSampCo (Columbus, Ohio) is expected during the first week of November. This represents a slippage of delivery of eight weeks.

Carbon Tetrabromide:

The program to study the CBr_4 problem is underway. The original program has been redirected as the result of several unexpected breakthroughs. The first breakthrough came with the securing of a new crude source of CBr_4 (BDH, England). This material surprisingly gave reasonable photographic results without purification and sublimation only serves to give improved results. This source is, however, three times as costly as the current source (Freeman Industries) and delivery times (from England) are long; two to three months. This source does offer an alternate supply, however, and the potential of simplified purification procedures can be expected to reduce the cost differential. Inquiries are being made about the obtaining of bulk quantities at lower costs.

This discovery in turn led to the second breakthrough, which is of more immediate interest. In attempting to determine the difference between the BDH and Freeman materials it was discovered that TLC (thin layer chromatography) reveals an impurity in "bad" (photographically unacceptable) CBr_4 . To date there is a 100% correlation between the presence of impurity in "bad" material and its absence in "good" (photographically acceptable) material. The impurity is noticeably absent from

the BDH crude and is present in the Freeman crude. Purification of the Freeman crude by recrystallization gives "good" CBr_4 , in which the impurity is absent. On standing in the solid state this material becomes "bad" and the impurity is then found to be present.

These observations leave no doubt that this detected impurity is directly associated with the CBr_4 problem, and it appears certain that this impurity is the direct cause of photographic failure. Furthermore, its formation from "good" material on standing (from Freeman) is either autocatalytic (i.e. due to its own presence in trace quantities) or due to another undetected impurity which is either not present in the BDH material or is introduced during the purification of the Freeman material. In any event, the first step in understanding the chemistry of the CBr_4 problem is the identification of this detected impurity. The original program has therefore been redirected toward the isolation and identification of this impurity. Thus far attempts to isolate the impurity have met with failure but work continues. Attempts are also being made to identify the impurity directly, without prior isolation.

Polystyrene Binder:

The expanded study of polystyrene binders which was planned for early October was begun, but then abandoned in favor of an increased effort to begin pilot coating of P-325A material. The lack of sufficient manpower prevents sustaining more than one significant effort at a time, and in this instance that effort is pilot coating!

New Materials:

The final sample, D409, of a series of simply substituted leuco malachite greens has been prepared.

Two new leuco triethenymethane dyes, D408 and D410, have also been prepared. These two have significant structural changes and produce gray to black dyes with high tinctorial strength.

[REDACTED]

In the study of the new leuco compounds, film evaluations to date have shown poor photoresponse. This contrasts with previous experiences at [REDACTED] and is believed to be associated with the presence of impurities as was discussed last month with respect to LMG (leuco malachite green). The effort to purify LMG is still underway, but has been retarded in view of the CBr_4 problem and the pilot coating effort. 25X1

The last sensitizing dye, D402, of the original sensitization has been prepared. Film evaluation of this and all other new materials has been reduced to a minimum or suspended in view of the increased effort toward pilot coating.

Film Studies

The sole effort of the film evaluation group during October has been directed toward problems associated with pilot coating. This effort was begun with studies directed toward the optimization of formula 5/D7.

D7 and 4PO (1673-46 through 50):

Combined traversals of D7 and 4PO have established that the optimum level of D7 is the current level of 64 mg. The current 4PO level of 20 mg was found to be close to optimum, but data thus far compiled indicates a preferred level of 28 mg.

CBr_4 :

A traversal of CBr_4 shows increasing density and a decreasing development time with increasing concentration. The optimum range of CBr_4 is 1.0 to 1.4 grams with an apparently preferred level of 1.2 grams.

Silicone Oil (DC 510):

The fine coating lines which have been observed to date have been identified as orange peel. This phenomenon occurs during the early stages of drying and can be prevented by adding traces of a silicone oil (DC 510).

A traversal (1769- 3 through 6) of DC 510 showed that a minimum of about 4 mg is necessary to prevent orange peel. At levels somewhere above 450 mg the oil begins to show adverse effects on both physical and sensitometric properties of the film.

Coating Thickness Variation:

The standard wet coating thickness has been 1.5 mils. A series of coatings were made in which the wet thickness was varied from 1.0 to 1.5 mils in 0.1 mil increments (1769-13). A significant drop in densities was observed between 1.4 and 1.3 mils, and the 1.4 mil coating actually looked better in quality than the standard 1.5 mil thickness. Incremental increases above 1.5 mils was not possible but a large jump to 3.0 mils resulted in rapid onset of fog and blotch with very poor imaging.

An alternative approach to coating thickness variation was also tried (1170-3). The standard coating solution was diluted with additional benzene by 5%, 12.5% and 25%; and 1.5 mils wet. There was a significant drop in densities between 12.5 and 25% dilution, thus relating this dilution range to the 1.4 to 1.3 mil wet thickness range. Several attempts were also made to coat diluted solutions at 3.0 mils wet thickness in order to obtain effective wet thicknesses greater than 1.5 mils. Only a few experiments were run and the results very inconclusive, but those results obtained suggest that a wet coating thickness greater than 1.5 mils might result in some improvement in densitometric properties.

Chemical-Binder Ratio (1769-11):

Some very crude, preliminary experiments were performed in order to gain some idea of the optimum chemical-binder ratio (total weight of all chemicals to total weight of

polystyrene). The normal 10% polystyrene-benzene solution was altered to 5%, 7.5%, 12.5% 15% and 20% polystyrene. The 12.5% and 15% solutions gave comparable but less desirable results than the standard. All the other percentages of polystyrene showed severely reduced image-to-fog ratios. Now that the effective range of 7.5% to 15% has been established more elaborate experiments have been planned. These experiments will attempt to account for the concomitant variations of wet and ultimately dry thicknesses which will result from varying binder content and chemical loading.

Pilot Coating

October marked the beginning of a concerted effort among coating personnel, engineers, the materials' group and the film coating and evaluation group to machine coat P-325A prime film material - 5/D7.

The materials' group prepared and purified to photo-grade quality all necessary materials in quantities sufficient to meet the estimated short-term requirements for pilot coating.

The film evaluation group began optimization studies of 5/D7. The results to date have already been described in Section 1.0. As a first look, some of the optimization studies (e.g. dry thickness and chem/binder ratio) were coarsely designed but the results indicate that the existing formulation for 5/D7 is already close to optimum. With these results the decision was made to scale-up the existing formulation without change; with the single exception of adding DC510 silicone oil, which has been found necessary for the prevention of orange peel.

Concurrent with the laboratory effort, the pilot coating group began preliminary work necessary for the actual coating of 5/D7. Dry thicknesses of lab coated films were measured and found to be:

- 1) 10% Polystyrene/Benzene (unloaded): 0.16 mil
- 2) Loaded: 0.30 mil
- 3) Fixed: 0.26 mil

The viscosity for meniscus coating to a loaded, dry thickness of 0.30 mil was then determined experimentally and found to be about 12 cps.

These preliminaries resulted in several actual runs with formula 5/D7. The conditions and results of these runs are tabulated on the accompanying data sheet (p. 8). The results of these runs are summarized as follows:


1) Run 325001 showed that, as had been expected, attempts to dry at elevated temperature results in fog.

2) Run 325002 demonstrated the ability to apparently retain good sensitivity by drying at ambient temperature. However, a viscosity of 12 cps, which is necessary to produce the desired dry thickness of 0.30 mil, results in coating patterns so terrible that quantitative sensitometry is impossible.

From these runs and more importantly, from much previous experience with other films systems, it is concluded that benzene is a poor solvent for producing good coating quality by the meniscus technique.

Direct observation of the coating process showed that the coating solution was applied properly and appeared to wet the web smoothly. However, at a distance of several inches from the point of application, where the solution begins to lose solvent, the wet coating began errupting into an extremely turbulent discontinuity of liquid. This violent looking pattern was observed to be identical to the pattern observed at the exit end of the coating oven. This pattern, its cause and affect, are similar to that experienced earlier with pure methylene chloride coatings of Type 2000. The pattern is believed to result from the too rapid loss of solvent with an accompanying rapid build up in viscosity of the coated solution. The coatings' viscosity then becomes sufficiently high to prevent flow of this disruption caused by the rapid loss of solvents; benzene in this case.

The effect described above can be eliminated by the choice of a solvent whose evaporation rate is substantially slower than benzene. Experience with the Talboys coater and Type 2000 film shows that a good solvent would be ethylene



dichloride. While this solvents' drying pattern is not perfect, it is apparently sufficiently slow to produce much slower increases in the viscosity of the coating. This then permits the coating to level or flow out, smoothing and resmoothing the nonuniform drying pattern of the solvent until eventually the viscosity is sufficiently high so that further solvent loss has no effect on the pattern. Once this state of rigidity in the coating is reached more violent air movement can then be used to dry the film.

To illustrate this point a placebo (D290 in place of D260) was run using ethylene dichloride as solvent. The chem/binder ratio and all other conditions were constant. The result was a dramatic transformation of uniformity and the coating pattern from the poor results obtained with benzene to the smooth acceptable patterns common to the present Type 2000 and Type 2500 products.

Results of the placebo have led to the consideration of ethylene dichloride as well as other potentially useful solvents as replacement for benzene. No solvent other than benzene has been investigated on this Project and so a laboratory investigation will be necessary. A number of potentially useful solvents (from the standpoint of coating) have been selected and an investigation has begun.

The decision to look at other solvents was made in order to provide a realistic alternative to coating the current 5/D7 formulation, and to provide some long overdue, fundamental information concerning the effects of solvent on photographic properties. This decision does not preclude further interest or consideration of machine coating with benzene, and work in this direction will continue concurrent with work directed toward replacing benzene.

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P-325A PILOT COATING DATA

October, 1971

Run	Solvent	Viscosity (cps)	Coating Speed (fpm)	* Oven Zone(°F)			Pattern	Comments
				#1	#2	#3		
325001	ØH	12	17.2	off	100	100	Very Poor	Fogged, dry
325002	ØH	12	17.2	off	off	on	Very Poor	No fog, tacky, Good quality sens; pattern no good for quantitative sens. Sensitivity to development but pat- tern too poor to develop image.
325003	ØH	5	12fpm	off	off	on	Very Poor	Good printout sens. Too thin for good dens. Sensitivity to development reduced probably due to both thin coating and age of coating solution. (~1.5 hour old)

2.0 PHYSICAL AND OUTGASSING TESTS

The preliminary film property tests on 325A hand coated samples yielded results very similar to Type 1414. Based on these data few major design constraints appear necessary. This conclusion is preliminary since the testing was on hand coated samples, the number of samples was limited, and the coating formula may not be the same as pilot coatings. Continued testing on a periodic basis especially as machine coatings become available will be necessary.

The following preliminary 325A film (1/3 mil coating on 5 mil base) property tests were performed by Perkin Elmer. Comparisons were made to Type 1414 which is coated on a 2 mil thick base.

Modulus of Elasticity lbs./inch²

6.3 x 10⁵ with coating
6.7 x 10⁵ with coating,
but assuming no contribution to E for coating.

Film Type 1414 6.2 x 10⁵

Film Resistivity x 10⁹

	Coating Side			Backing Side		
	x	y	Z axis	x	y	Z axis
H-325	3.8	4.5	29	4.1	4.2	29
1414	3.5	3.5	21	4.0	4.6	21

The difference between the 2 film types is considered insignificant.

Creep Test inch/inch at 75°F in 3 days

	30% R.H.	40% R.H.
H-325	+.000130	+.000018
1414	-.00033	+.000002


Film Friction + Sticking Test

The coefficient of friction of 1414 is higher than H-325 for both the emulsion side and Mylar side at 75°F and 40% and 70% R.H.

Film Outgassing

The outgassing test procedure, especially the handling of 325A film, must be improved to yield the desired data and confidence. The rapid outgassing from fresh coating and the resultant significant effect of storage and handling procedures prior to testing frustrated comparisons of data. The qualitative data were also inconclusive.

Compatibility Testing at 120°C for 14-16 hours

Materials	Results
Invar No. 36	Slight Attack
Stainless Steel No. 302,304	Slight Attack
Aluminum No. 6061	Slight Attack
Beryllium	Unaffected
White Raychem Wire	White changed to pink color-certain areas

Scuffing Resistance

No tests completed at this time.

3.0 ENGINEERING

Granularity Measurements

In preparation for granularity measurements on pilot coated type 325A films, a task was laid on to measure granularity of Type 2000 duplicating films. This request was directed to Perkin Elmer and Eastman Kodak. Due to problems in setup of the Perkin Elmer microdensitometer, their measurements are as yet to be done. Eastman Kodak has attempted granularity measurements on Type 2000; three considerations on a preliminary basis have been concluded: measurement of granularity on a molecular structure material is not straight forward, as the noise level of the microdensitometer may be above the granularity excursion, granularity of Type 2000 films may be an order of magnitude above comparable silver materials and D.Q.E. Assessments of molecular structure materials with a formula involving selwyn granularity may not be possible.

Optical Probe

The purchase order covering lease of the Itek-Kingsbury optical ranging probe for project use in noncontact layer thickness measurements has been cancelled. The vendor was not able to supply a delivery date, and operational problems with this unit implied that results might be suspect. Other systems involving contact measurements are being investigated. These are not as desirable as they involve removing a section of the coated layer for thickness measurements.

Pilot Coating - Process Air and Ventilation

Scope of Project:

- A. To provide good ventilation, temperature and humidity control to those areas in which explosive or toxic conditions may exist due to the use of dangerous solvents or chemicals. The areas affected are the coating room, the mix room and the proposed solvent and chemical vault.
- B. To provide process air to the present furnaces that is both safe, in terms of explosive content, and has a water content below 54 grains.

Specifications:

A. Outside Conditions - Winter--15°F - 0 grains
Summer--95°F - 180 grains

B. Coating Room

Incoming air - all air used for ventilation of the coating room will be brought in from the outside. Due to changing outside conditions this air must be processed in such a manner as to maintain the following conditions in the coating room year round.

Temperature - 68-72°F

Grains H₂O/lb. of Air- 50-54

All incoming air is to be filtered through .3 micron filters. The volume of air will be 3500 cfm of which 3000 cfm will be exhausted from the area of the coating head. The exhaust duct will be designed so as to efficiently draw all solvent fumes at floor level from an area approximately 6 ft. by 10 ft. The remaining 500 cfm will be exhausted at the windup end of the machine.

After exhausting, the exhausted air will be sampled by a Davis instrument to determine whether the vapors collected are safe for reuse in the furnaces as process air. Refer to safety features and automatic controls for list of what happens in the event that the air sampled is not safe. Types and combinations of solvents to be sampled will include acetates, aromatics, aliphatics, chlorinates, benzene, acetone, toluol and ketones.

After sampling, the air will be split into two parts: 1800 cfm will be sent to the existing furnaces while the remaining 1700 cfm will be exhausted to the outside.


C. Mix Room Ventilation

Ventilation for the mix room using outside air will be required to maintain the following conditions year round:

Temperature ----- 68° - 72°F

Relative Humidity --- 50 - 60%

Volume ----- 2000 cfm



Exhausting will be done around the mix tank area from floor level and be designed to keep the area free of solvent vapors. It is hoped that as much of our present equipment as possible can be utilized. Rough filtering of air will be all that is required. All exhaust will be dumped outside the building in a safe area.

D. Storage Area

The ventilation system will be required to provide 500 cfm at the following conditions:

Temperature ----- 65° - 75° F

Relative Humidity ----- 80% minimum

Air need only be coarse filtered. All exhaust will be dumped outside. Incoming air is to be taken from outside the building. This system can be combined with the mix room with additional humidification added.

Exhaust to be from floor level for efficient elimination of vapors.

E. Ventilation of Film Room and Change Room

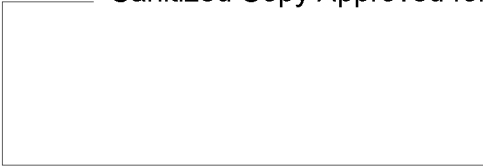
These two rooms require low volumes of clean air change. The present system of ventilating the mix room can be reduced to these two areas to provide sufficient ventilation with the addition of .3 micron filters. Since there are no solvents or dangerous chemicals in these areas the present recirculating exhaust system may be used.

F. Safety

All controls in the coating room, mix room and storage room that may come into contact with solvent vapors must meet UL Class I, Group D specifications.

G. Safety Features and Automatic Controls (Ref. Figure 1)

1. In the event solvent concentrations are too high, the Davis meter will simultaneously:

- 
- a) open damper C, increasing exhaust from 1700 cfm to 3500 cfm
 - b) close damper D₂
 - c) open damper D₁
 - d) shut off machine drive after predetermined time delay (3 min. adjustable)
 - e) shut off liquid supply (when recirculating system is installed) provide signal only at present
 - f) alarm sounds
 - g) heaters are shut off

An override switch is to be provided such that operations may be continued with damper C open, D₂ closed and D₁ open.

2. In the event fan No. 4 fails:

- a) entire system shuts down, including fluid supply and coating machine
- b) alarm sounds

3. In the event that conditioner No. 1 fails:

- a) entire system goes down, including fluid supply, coating machine, etc.
- b) alarm sounds

H. Schedule (Dates and times to be added at a later date)

- 1. The coating room ventilation and process air system can be built and installed without interruption of normal coating. After the system is complete, except for actual installation work in the coating room, the coating operation will be stopped for approximately two days while connections are made.
- 2. Ventilation for mix room and storage area is to be done after the coating room ventilation system is installed and normal operations resumed.
- 3. Change room and film storage conversion is to be made after the mix room facilities are changed. These areas will be without ventilation for the period between coating room conversion and installation of the new recirculating system for that area.

I. Component List

1. New 3500 cfm air conditioning, dehumidifying, heating and humidifying installation
2. New absolute filter
3. Davis meter
4. Two-speed exhaust fan - 1700 or 3500 cfm
5. New 2500 cfm air conditioning, dehumidifying, heating and humidifying installation
6. 500 cfm humidification
7. 2500 cfm exhaust fan
8. Absolute filter
9. Present mix room air conditioning system
10. To existing furnace system
11. Dampers
 - a) fire detector operated dampers
 - b) (2) position operated dampers
 - c) full open or full closed dampers

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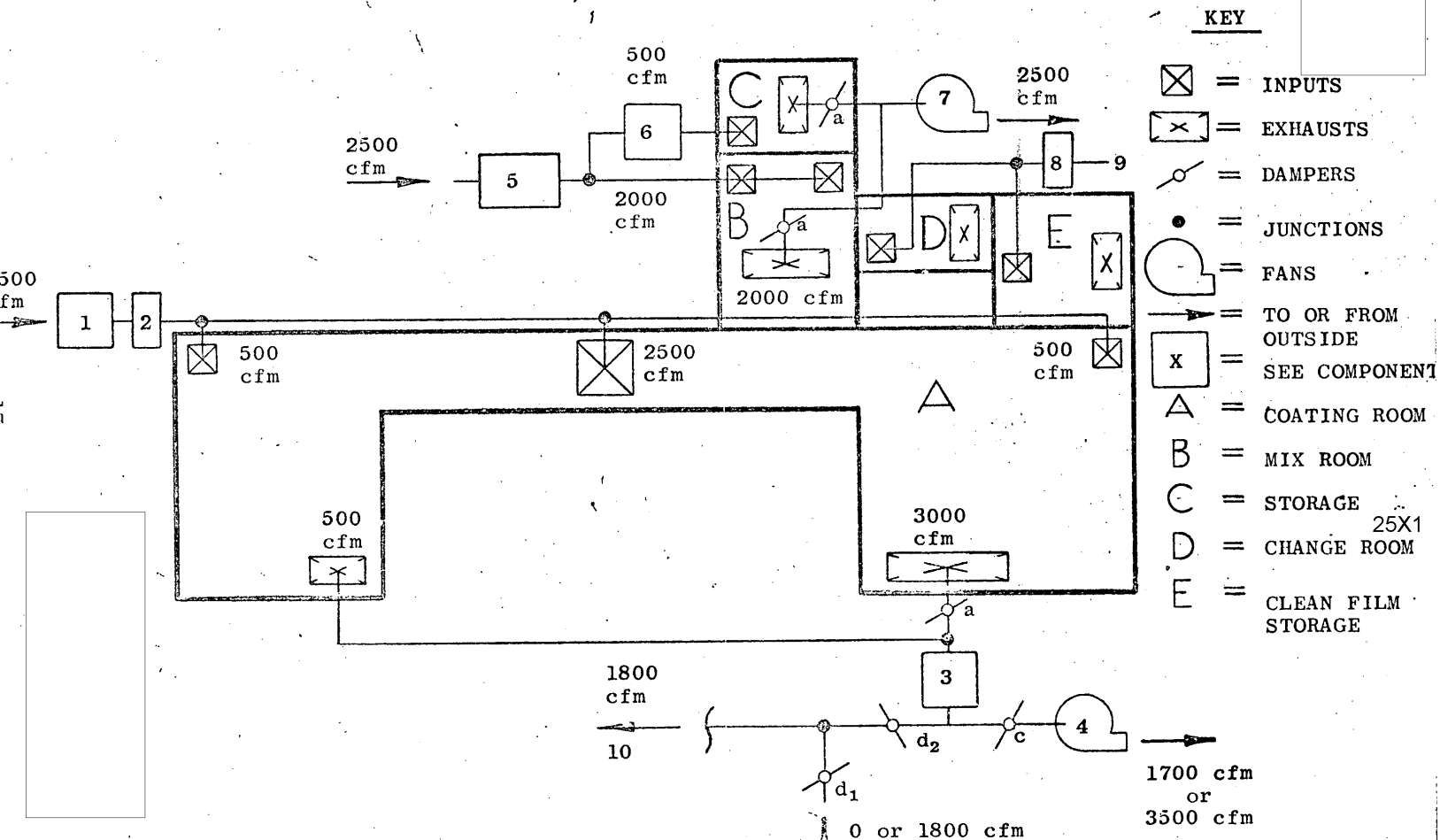
SUMMARY OF SPECIFICATIONS

<u>Location</u>	<u>Temperature</u>	<u>Humidity</u>	<u>CFM</u>	<u>Filter</u>
Outside:				
Winter	-15°F	0		
Summer	95°F	180 grains		
Coating Room	68-72°F	50-54 grains	3500	.3 micron
Mix Room	68-72°F	50-60%RH	2000	coarse
Storage	65-75°F	80% Min RH	500	coarse
Change Room	Comfort	Comfort		.3 micron
Film Storage	Comfort	Comfort		

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FIGURE 1

SCHEMATIC VENTILATION
FOR TALBOY COATER
AND ASSOCIATED AREAS




Pilot Coating - Temperature Control for Process Dryers**Scope:**

To provide temperature control within $\pm 1^\circ\text{F}$ for the three zones of the process dryer.

Specifications:**A. Power Control**

The present contractors will be replaced by SCR - Burst or phase control power controllers. The unit will be three phase, 208 volts, 150-200 amp service, and have fail-safe features.

B. Temperature Control

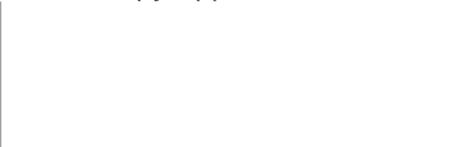
The temperature controller will be of the potentiometer type and have a proportional bandwidth of 1% or less of the range. The temperature range to be controlled will be 70 - 350°F. The controller will have temperature indication as well as set point indication. The set point accuracy to be about 1% of full scale range. Controller to be automatic resetting and ambient temperature compensating.

C. Temperature Sensor

The sensor will be either on open junction Iron-Constantan thermocouple or an ultrasensitive mercury filled capillary type.

Microdensitometer

A short term bailment of a Joyce Loebel MKII Microdensitometer has been arranged with the Air Force Avionics Laboratory, Reconnaissance Division, Photographic Branch, Wright Patterson Air Force Base, Ohio. Although this unit is for use on other projects, the 325A project will have use of same.



Red Light DevelopmentsSilicone Additive for Use in Limiting Surface Defects with Hand Coatings:

Typical 325A hand coatings exhibit some surface defects which are probably due to a drying phenomenon associated with the surface of a coating. It was found that a trace amount of Dow Silicone 510 (10 μ gram/4cc coating) introduced into the coating solution remedied these coating defects. There was some change in the sensitometric curve caused by silicone additive; however, with the proper room and platen temperature control, these sensitometric changes can be overcome. Figure 2 shows a D log E curve of 325A film, formula 5/D7, with a silicone additive. Figure 3 shows the same sample traced on a Joyce Loeb1 microdensitometer. This particular sample was read with 100 micron slit width and a 10X objective.

Room temperature was found to have a drastic effect on the type of sample produced. Figure 4 shows the characteristic curve of formula 5/D7 with a room and platen temperature of 65°F; the γ was 0.3. Another sample run at a high room temperature of 88°F and a platen temperature of 67°F, yields a somewhat higher γ of 2.0 and many more steps in the high density areas; Figure 5 .

Use of Environmental Cover on HID-I:

A series of samples was run on the HID-1 optical development unit with the environmental cover in place over the platen. A control was run with atmospheric pressure inside the environmental cover. The control run with environmental cover in place was very similar to a previous control run without environmental cover, although development times were slightly longer. Samples were also run under vacuum and with a pressurized environmental cover. Figure 6 shows a characteristic curve for formula 5/D7 with a silicone additive, the environmental cover in place and a pressure of 1-1/4 atmospheres, attained through the use of a portable lab compressor. This sample was found to take approximately 50% more time to develop than the control run at atmospheric pressure. However, the quality of the sample was not seriously altered. The color, densities, speeds and curve shape are quite typical of samples attained at atmospheric pressure.



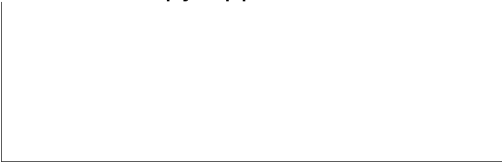
With the environmental cover in place and a vacuum of $2/3$ of an atmosphere, development times were found to be much faster than normal. There was also an apparent loss in film speed and a change in the curve shape, Figure 7. The γ tended to be higher and the apparent color of the image appeared neutral when viewed by transmission; however, the blue, green and red ratios as read on the MacBeth micro-densitometer did not appear to change significantly. It was concluded that while samples could be optically developed under a partial vacuum, this did not appear a very promising route to follow in an attempt to increase film speed. Testing is continuing with the use of the environmental cover and various gases used for back filling; namely, oxygen, nitrogen, argon and mixtures of same.

Effect of Time Delay Between Optical Development and Solvent Fix:

A sample was prepared, exposed and optically developed on the HID-1 red-lite unit and then cut in half. Half the sample was liquid fixed immediately and the other half was held in dark storage for one hour before solvent fixing. The two D log E curves are shown in Figure 8. There was a slight fog build up of 0.1 and a D_{max} build up of 0.1. There was no apparent shift in the speed point between the two samples. This test was repeated with similar results. Further work is necessary in this area before a complete characterization of this film parameter can be identified.

Electroluminescent Panels:

Additional work was done in the area of new optical developments red-lite sources. A GE red electroluminescent panel was acquired and spectral energy measurements made. The spectral distribution is shown in Figure 9. This panel is essentially a green electroluminescent panel with a red phosphor coating. The energy levels are quite low; 50 nanowatts/cm²/nm at 650 nm compared with the minimum 2.7 milliwatts/cm² found necessary at 690 nm. The sample of 325A film was, however, optically developed using the electroluminescent panel. Density amplification resulting from optical development with the electroluminescent panel was only minor since with a base + fog of 0.4 the density in the maximum density step was only 0.5. The fog level was



quite high and probably the result of the relatively large amounts of energy at 620 and 630 nm present with this panel. No filtration was used since the unfiltered power levels were so low. If a panel could be found with higher initial energy levels or a better conversion factor within the phosphor coating, this light source might deserve further effort since it is a low power relatively uniform and fairly inexpensive light source.

B+F

FIGURE 2

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25X1

PROJECT 325A

DATE: 10-1-71

PREPARED BY:

TIME:

FORMULA: 5/D7 NTBK: P
 + Silicone Additive for Imp
 of Hand Coatings
 CHEMICALS USED:

EXPOSURE STATION:

INTENSITY: 220.5 mc

EXPOSURE TIME: .088 sec.

E EXPOSURE: 19.35 mc sec.

Log EXPOSURE: 1.28

RED LITE STATION: HID-1 LAMP: 35K

STATIONARY PLATEN: X OSCILLATING:

RED LITE DEV. TIME: 47 sec.

TIME/PASS:

FILTERS USED: 665 RG2030 N.D.:

25X1

RADIATED POWER:

ROOM TEMP: 69°F Typical Room Temp.

HUMIDITY:

PLATEN TEMP: 67°F Slightly low Platen
 Temp.

 $\gamma = 1.25$

AEI: .365

RELATIVE LOG EXPOSURE

Abs. Log E 1.28 ↑

NORMAL ROOM TEMPERATURE

10 X 25 CM

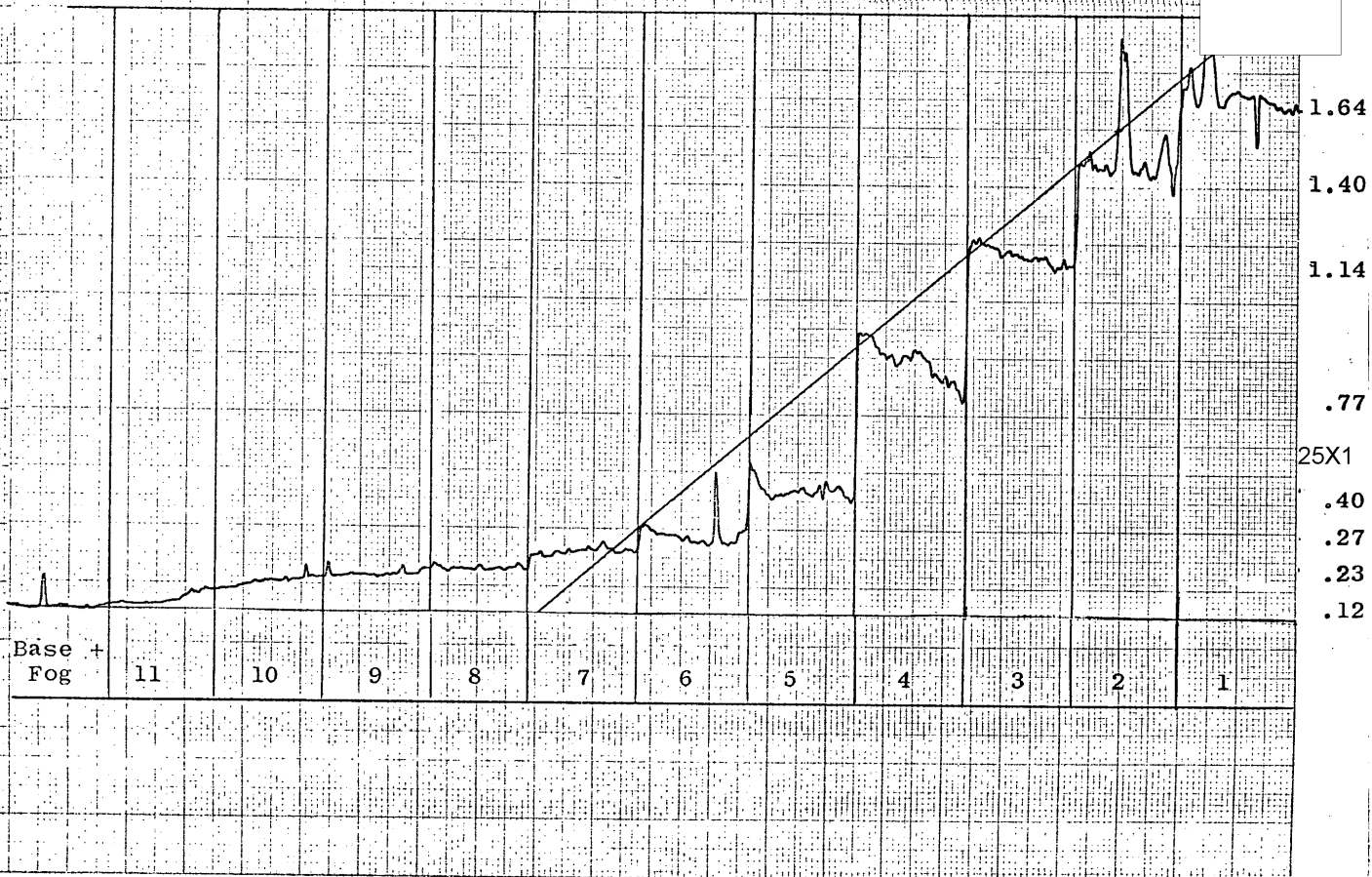
MADE IN U.S.A.

KIEFFEL & ESSER CO.

25X1

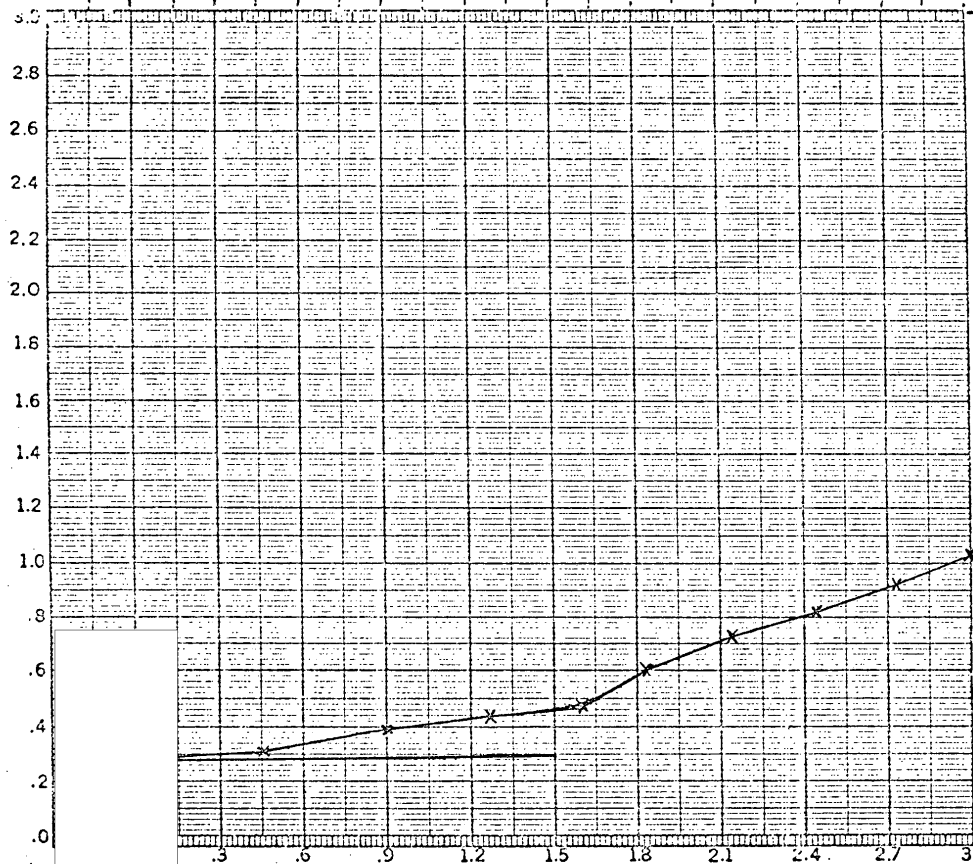
FIGURE 3

Mech. Slit 2.0mm
Objective 10X
Actual Slit Approximately 100 μ
0 - 3.0 D Wedge
5:1 Ratio Arm



E-F

.29			.31	.41	.46	.53	.67	.80	.89	1.05	1.14
.28			.31	.42	.44	.48	.61	.72	.82	.92	1.02
	1	2	3	4	5	6	7	8	9	10	11



RELATIVE LOG EXPOSURE

Abs. Log E 1.28

LOW ROOM TEMPERATURE

FIGURE 4

PROJECT 325A

DATE: 10-6-71

PREPARED BY:

TIME:

FORMULA: 5/D7 NTBK: P
 + Silicone Additive for Imp t
 of Hand Coatings
 CHEMICALS USED:

EXPOSURE STATION:

INTENSITY: 220 mc

EXPOSURE TIME: .088 sec.

E EXPOSURE: 19.35 mc sec.

Log EXPOSURE: 1.28

RED LITE STATION: HID-1LAMP: 35K

STATIONARY PLATEN: X OSCILLATING:

RED LITE DEV. TIME: 45 sec.

TIME/PASS:

FILTERS USED: 665 RG 2030N.D.:

RADIATED POWER:

ROOM TEMP: 65°F Low Room Temp.

HUMIDITY:

PLATEN TEMP: 65°F Low Platen Temp.

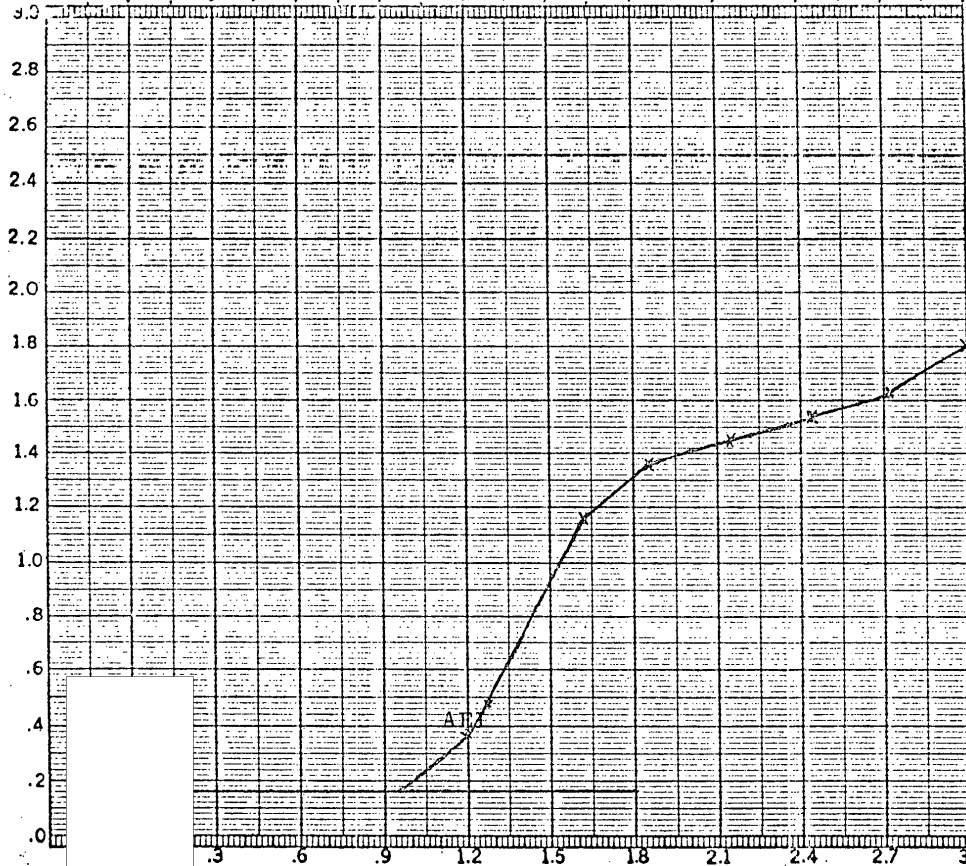
 $\gamma = .31$

AEI:

B+F

FIGURE 5

.18					.54	1.36	1.56	1.63	1.68	1.72	1.80
.16					.49	1.17	1.36	1.45	1.54	1.62	1.80
	1	2	3	4	5	6	7	8	9	10	11



RELATIVE LOG EXPOSURE

Abs. Log E 1.28 ↑

HIGH ROOM TEMPERATURE

PROJECT 325A

DATE: 11-1-71

PREPARED BY:

TIME:

FORMULA: 5/D7 NTBK:
+ Silicone Additive for I
of Hand Coatings
CHEMICALS USED:

EXPOSURE STATION:

INTENSITY: 220 mc

EXPOSURE TIME: .088 sec.

E EXPOSURE: 19.35 mc sec.

Log EXPOSURE: 1.28

RED LITE STATION: HID-1 LAMP: 35 K

STATIONARY PLATEN: X OSCILLATING:

RED LITE DEV. TIME: 38 sec.

TIME/PASS:

FILTERS USED: 2030 N.D.:

RADIATED POWER:

ROOM TEMP: 88°F High Room Temp.

HUMIDITY:

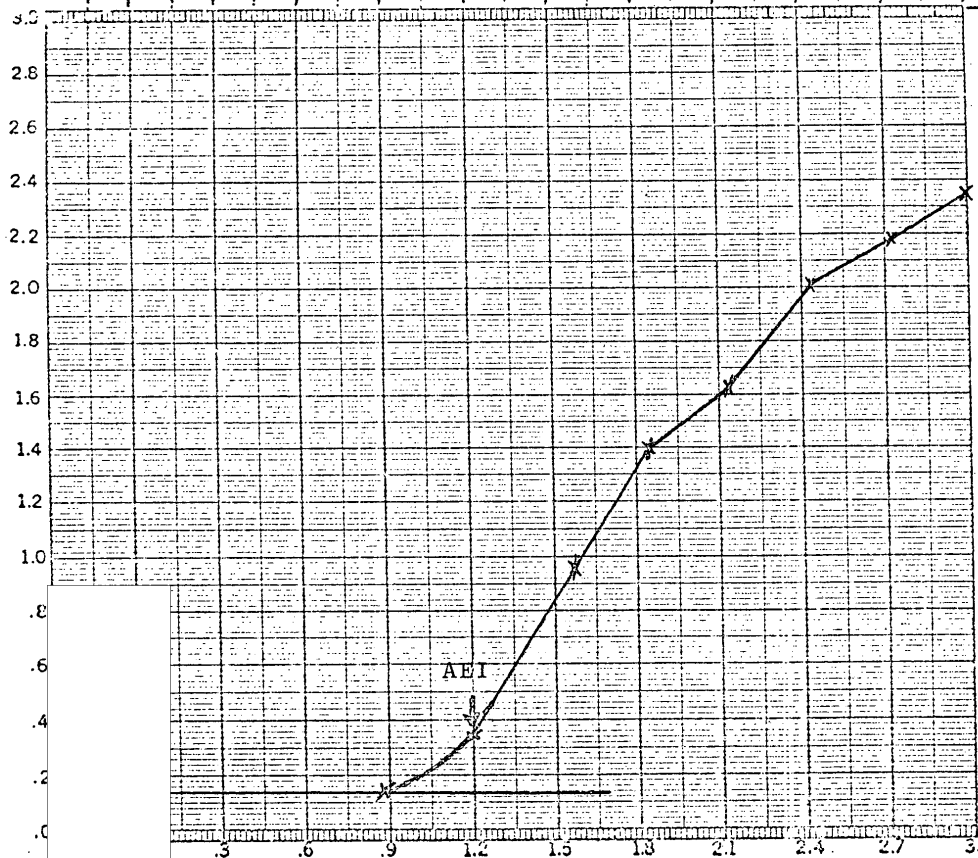
PLATEN TEMP: 67°F Low Platen Temp.

$\gamma = 2.0$

AEI: 1.63

B+F

.14				.14	.37	1.03	1.52	1.73	1.88	1.92	1.94
.13				.13	.35	.96	1.40	1.64	2.00	2.18	2.36
	1	2	3	4	5	6	7	8	9	10	11



RELATIVE LOG EXPOSURE

Abs. Log E 1.28 ↑

PRESSURIZED COVER

FIGURE 6

PROJECT 325A

DATE: 11-2-71

PREPARED BY:

TIME:

FORMULA: 5/D7 NTBK:

+ Silicone Additive for
CHEMICALS USED: Hand Co

EXPOSURE STATION: Environmental
INTENSITY: 220 mc Cover
EXPOSURE TIME: .088 sec. 5 lbs. pressure
E EXPOSURE: 19.35 mc sec.
Log EXPOSURE: 1.28

RED LITE STATION: HID-1 LAMP: 35K
STATIONARY PLATEN: X OSCILLATING:
RED LITE DEV. TIME: 60 sec.
TIME/PASS:
FILTERS USED: 2030 N.D.:
RADIATED POWER: 25X1

ROOM TEMP: 82°

HUMIDITY:

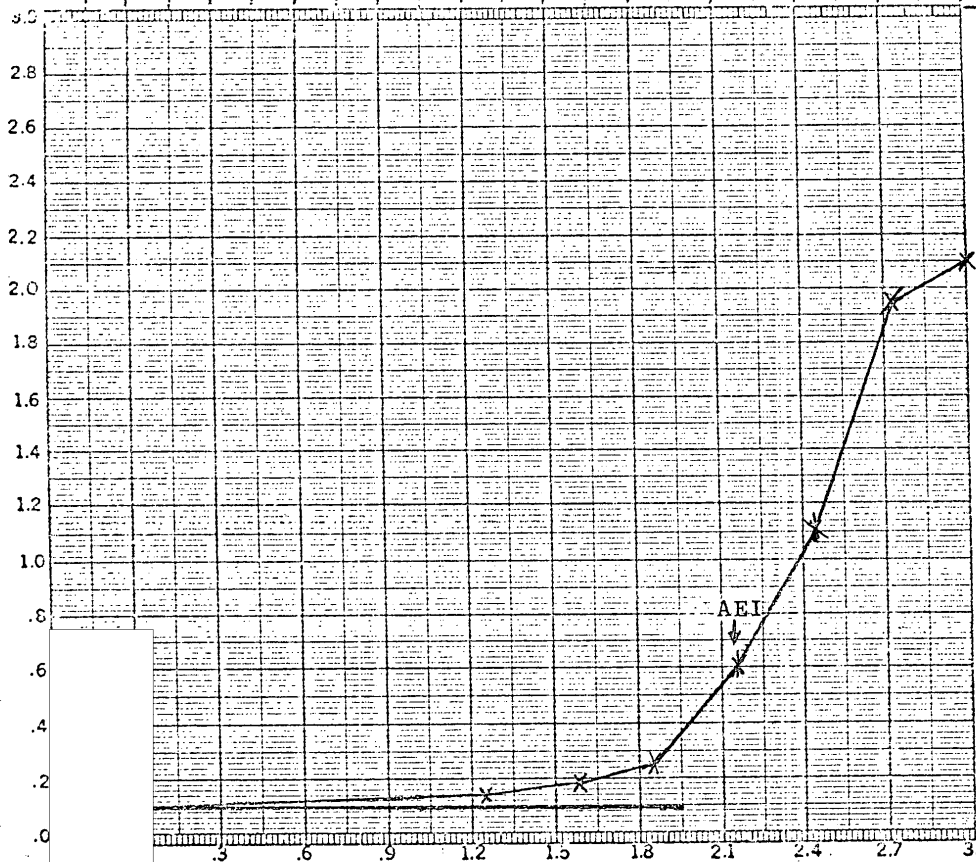
PLATEN TEMP: 70°

 $\gamma = 1.3$

AEI: 1.62

B+F

.12					.15	.20	.27	.62	1.11	1.85	1.88
.10					.14	.18	.25	.60	1.10	1.95	2.10
	1	2	3	4	5	6	7	8	9	10	11



RELATIVE LOG EXPOSURE

Abs. Log E 1.28 ↑

PARTIAL VACUUM

FIGURE 7

PROJECT 325A

DATE: 11-3-71

PREPARED BY:

TIME:

FORMULA: 5/D7 NTBK:

No Silicone

CHEMICALS USED: - 16" m

EXPOSURE STATION:

INTENSITY: 220 mc

EXPOSURE TIME: .088 sec.

E EXPOSURE: 19.35 mc sec.

Log EXPOSURE: 1.28

RED LITE STATION: HID-1 LAMP: 35K

STATIONARY PLATEN: X OSCILLATING:

RED LITE DEV. TIME: 39 sec.

TIME/PASS:

FILTERS USED: RG 667 N.D.: 2030

RADIATED POWER:

ROOM TEMP: 81°F

HUMIDITY:

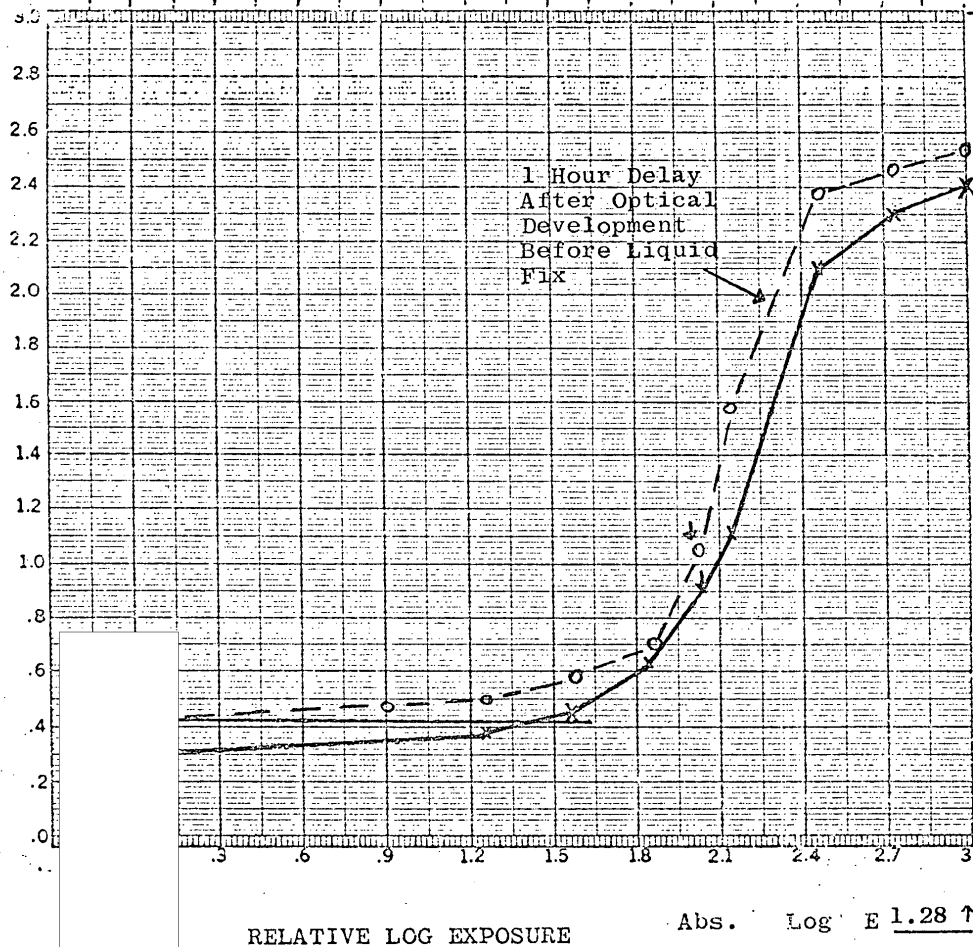
PLATEN TEMP: 70°F

 $\gamma = 2.5$

AEI: .182

FIGURE 8

B+F												
.42				.47	.51	.58	.70	1.58	2.37	2.47	2.53	
.30					.39	.46	.64	1.22	2.10	2.28	2.40	
	1	2	3	4	5	6	7	8	9	10	11	



PROJECT 325A

DATE: 10-13-71

PREPARED BY:

TIME:

FORMULA: 5/D7 NTBK:

No Silicone

CHEMICALS USED:

EXPOSURE STATION:

INTENSITY: 220 mc

EXPOSURE TIME: .088 sec.

E EXPOSURE: 19.35 mc sec.

Log EXPOSURE: 1.28

RED LITE STATION: HID-1 LAMP: 35K

STATIONARY PLATEN: X OSCILLATING:

RED LITE DEV. TIME: 45 sec.

TIME/PASS:

FILTERS USED: RG 667 N.D.: 2030

RADIATED POWER:

ROOM TEMP: 79°F

HUMIDITY:

PLATEN TEMP: 70°F

$$\gamma = \frac{x = 3.9}{o = 4.5}$$

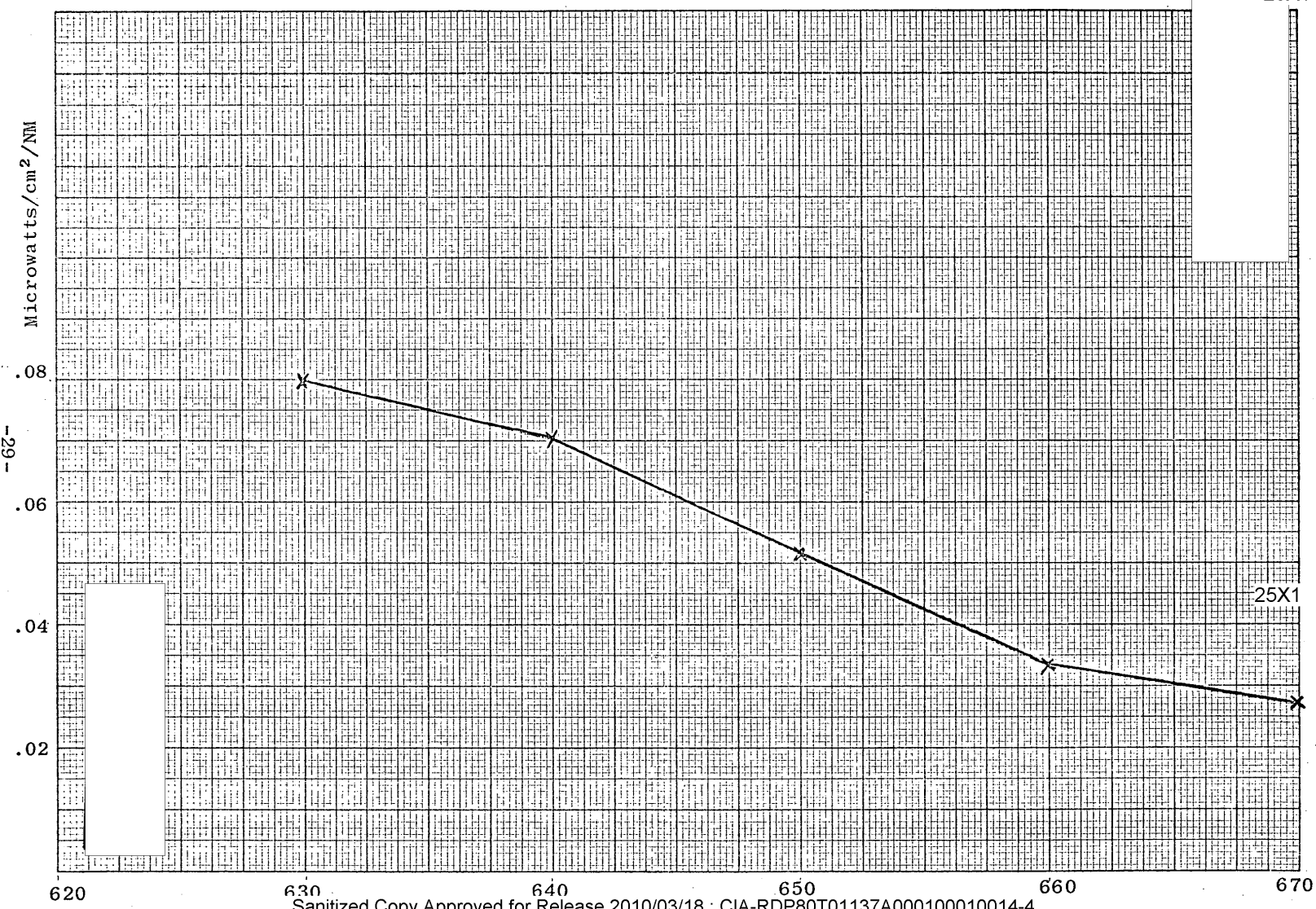
AEI: .298

STANDARD vs. ONE HOUR DELAY

K&E 7 X 10 INCHES KEUFFEL & ESSER CO. MADE IN U.S.A.

GE RED ELECTROLUMINESCENT PANEL

FIGURE 9



4.0 SHELF-LIFE/SPEED DECAY

The temperature traverse (0°C - 35°C) planned for this month, involving the low temperature freezer was not completed. Considerable problems were encountered with the freezer. Factory specialists attempted to resolve the problems with no satisfaction. A replacement unit has been promised.

PROBLEMS

1. No accurate method of measuring coating thickness without removal of the layer.
2. Chemical Samples Company delay in delivery of large quantities of D260 prime dye materials.
3. Delay in granularity measurements for use in finalizing the DQE, [] formula numbers.
4. The Itek recording densitometer requires extensive, costly modifications for project use. \$10,000 plus the unmodified price of \$9,995. The only recording densitometer available that may meet project needs is a QuantaScan Model 101-D at \$14,650. Tests are being conducted on this unit.

25X1

FINANCIAL

No written approval received for funds to cover the present 90 day effort.

PLANS FOR NEXT REPORTING PERIOD

1. Attempt to produce trial coatings of full formula 325A layers.
2. Analyze results and bear on problems associated with trial coatings.

25X1

3. Should testing of the Quanta Scan recording densitometer prove its suitability for project use, request additional funds for purchase of same.

4. Secure some understanding of follow-on work after January 1, 1971.

5. Difficulty in long term project planning and staffing due to short cycle project funding periods.

Page Denied